19-0236; Rev 3; 8/06

Precision, Quad, SPST Analog Switches

General Description

The MAX391/MAX392/MAX393 are precision, quad, single-pole/single-throw (SPST) analog switches designed to operate at +3V, +5V, or ±5V. The MAX391 has four normally closed (NC) switches, and the MAX392 has four normally open (NO) switches. The MAX393 has two NO and two NC switches. All three devices offer low leakage (100pA max) and fast switching speeds (t_{ON} ≤ 130ns, t_{OFF} ≤ 75ns). Power consumption is just 1µW—ideal for battery-operated equipment. All devices operate from a single +3V to +15V supply or from dual ±3.0V to ±8V supplies.

With ±5V supplies, the MAX391/MAX392/MAX393 offer guaranteed 2Ω max channel-to-channel matching, 30Ω max on-resistance (R_{ON}), and 4Ω max R_{ON} flatness over the specified range.

These switches are also fully specified for single +5V operation, with 2Ω max R_{ON} match, 60Ω max R_{ON}, and 6Ω max flatness.

These low-voltage switches also offer 5pC max charge injection, and ESD protection is greater than 2000V, per method 3015.7.

Applications

Battery-Operated Systems	Sample-and-Hold Circuits
Heads-Up Displays	Guidance and Control Systems
Audio and Video Switching	Military Radios
Test Equipment	Communications Systems
±5V DACs and ADCs	PBX, PABX

Features

- ♦ **Low On-Resistance, 20Ω Typical**
- ♦ **Guaranteed On-Resistance Match Between Channels, < 2Ω**
- ♦ **Guaranteed On-Resistance Flatness Over Signal Range, 4Ω Max**
- ♦ **Guaranteed Charge Injection, < 5pC**
- ♦ **Improved Leakage Over Temperature, < 2.5nA at +85°C**
- ♦ **Electrostatic Discharge > 2000V per Method 3015.7**
- ♦ **Single-Supply Operation (+3V to +15V) Bipolar-Supply Operation (±3V to ±8V)**
- ♦ **Low Power Consumption, < 1µW**
- ♦ **TTL/CMOS-Logic Compatible**

Ordering Information

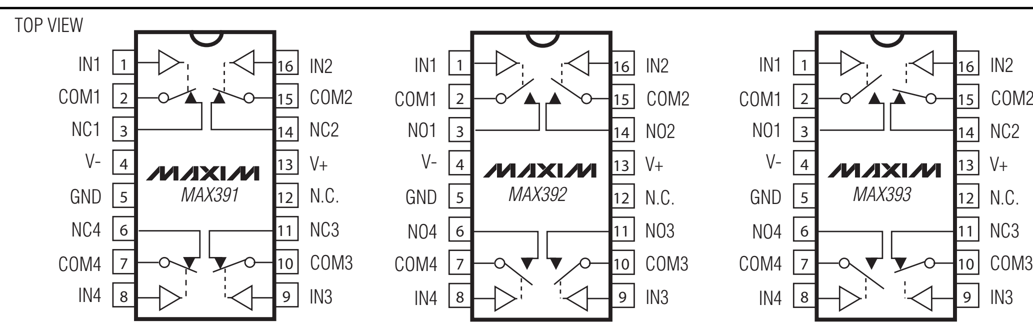
PART	TEMP RANGE	PIN-PACKAGE	PKG CODE
MAX391CPE	0°C to +70°C	16 Plastic DIP	P16-1
MAX391CSE	0°C to +70°C	16 Narrow SO	S16-2
MAX391CUE	0°C to +70°C	16 TSSOP	U16-2
MAX391CGE	0°C to +70°C	16 QFN-EP†	G1644-1
MAX391C/D	0°C to +70°C	Dice*	—
MAX391EPE	-40°C to +85°C	16 Plastic DIP	P16-1

Ordering Information continued on last page.

**Contact factory for dice specifications.*

†EP = Exposed pad.

Pin Configurations/Functional Diagrams/Truth Tables



DIP/SO (MAX391) · DIP/SO (MAX392) · DIP/SO (MAX393)

MAX391

LOGIC	SWITCH
0	ON
1	OFF

MAX392

LOGIC	SWITCH
0	OFF
1	ON

MAX393

LOGIC	SWITCHES 1, 4	SWITCHES 2, 3
0	OFF	ON
1	ON	OFF

N.C. = NO CONNECT

SWITCHES SHOWN FOR LOGIC "0" INPUT

Precision, Quad, SPST Analog Switches

ABSOLUTE MAXIMUM RATINGS

Voltage Referenced to V-
- V+ ....-0.3V to +17V
- GND..-0.3V to +17V
- GND..-0.3V to (V+ + 0.3V)

$V_{IN_}$, $V_{COM_}$, $V_{NC_}$, $V_{NO_}$ (Note 1) ....V- to V+
Current (any terminal) 30mA
Peak Current, COM_, NO_, NC_
- (pulsed at 1ms, 10% duty cycle max) 100mA

ESD per Method 3015.7 ....> 2000V
Continuous Power Dissipation (T_A = +70°C)
- Plastic DIP (derate 10.53mW/°C above+70°C) 842mW
- Narrow SO (derate 8.70mW/°C above +70°C) 696mW
- TSSOP (derate 6.7mW/°C above +70°C) 457mW
- CERDIP (derate 10.00mW/°C above +70°C)...............800mW
- QFN (derate 18.5mW/°C above +70°C) 1481mW

Operating Temperature Ranges
- MAX39_C_ _ ....0°C to +70°C
- MAX39_E_ _..-40°C to +85°C
- MAX39_M_ _..-55°C to +125°C

Storage Temperature Range ....-65°C to +150°C
Lead Temperature (soldering, 10s) ....+300°C

Note 1: Signals on NC_, NO_, COM_, or IN_ exceeding V+ or V- are clamped by internal diodes. Limit forward diode current to maximum current rating.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS—Dual Supplies

(V+ = +5V ±10%, V- = -5V ±10%, GND = 0V, V_{INH} = 2.4V, V_{INL} = 0.8V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP (Note 2)	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	$V_{COM_}$, $V_{NO_}$, $V_{NC_}$	(Note 3)			V-		V+	V
On-Resistance	R_{ON}	V+ = 4.5V, V- = -4.5V, $I_{COM_}$ = -10mA, $V_{NO_}$ or $V_{NC_}$ = ±3.5V	T_A = +25°C	C, E		20	35	Ω
				M		20	30	
			T_A = T_{MIN} to T_{MAX}				45	
On-Resistance Match Between Channels (Note 4)	ΔR_{ON}	V+ = 5V, V- = -5V, $I_{COM_}$ = -10mA, $V_{NO_}$ or $V_{NC_}$ = ±3V	T_A = +25°C			0.3	2	Ω
			T_A = T_{MIN} to T_{MAX}				4	
On-Resistance Flatness (Note 5)	$R_{FLAT(ON)}$	V+ = 5V, V- = -5V, $I_{COM_}$ = -10mA, $V_{NO_}$ or $V_{NC_}$ = ±3V	T_A = +25°C			1	4	Ω
			T_A = T_{MIN} to T_{MAX}				6	
NO or NC Off-Leakage Current (Note 6)	$I_{NO(OFF)}$ or $I_{NC(OFF)}$	V+ = 5.5V, V- = -5.5V, $V_{COM_}$ = ±4.5V, $V_{NO_}$ or $V_{NC_}$ = ∓ 4.5V	T_A = +25°C		-0.1	±0.01	+0.1	nA
			T_A = T_{MIN} to T_{MAX}	C, E	-2.5		+2.5	
				M	-5		+5	
COM Off-Leakage Current (Note 6)	$I_{COM(OFF)}$	V+ = 5.5V, V- = -5.5V, $V_{COM_}$ = ±4.5V, $V_{NO_}$ or $V_{NC_}$ = ∓ 4.5V	T_A = +25°C		-0.1	±0.01	+0.1	nA
			T_A = T_{MIN} to T_{MAX}	C, E	-2.5		+2.5	
				M	-5		+5	
COM On-Leakage Current (Note 6)	$I_{COM(ON)}$	V+ = 5.5V, V- = -5.5V, $V_{COM_}$ = ±4.5V, $V_{NO_}$ or $V_{NC_}$ = ±4.5V	T_A = +25°C		-0.2	±0.01	+0.2	nA
			T_A = T_{MIN} to T_{MAX}	C, E	-5.0		+5.0	
				M	-20		+20	

ELECTRICAL CHARACTERISTICS—Dual Supplies (continued)

(V+ = +5V ±10%, V- = -5V ±10%, GND = 0V, V_{INH} = 2.4V, V_{INL} = 0.8V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
LOGIC INPUT							
Input Current with Input-Voltage High	I_{INH}	IN = 2.4V, all others = 0.8V		-0.5	±0.005	+0.5	µA
Input Current with Input-Voltage Low	I_{INL}	IN = 0.8V, all others = 2.4V		-0.5	±0.005	+0.5	µA
DYNAMIC							
Turn-On Time	t_{ON}	$V_{COM_}$ = ±3V, Figure 2	T_A = +25°C		65	130	ns
			T_A = T_{MIN} to T_{MAX}			175	
Turn-Off Time	t_{OFF}	$V_{COM_}$ = ±3V, Figure 2	T_A = +25°C		35	75	ns
			T_A = T_{MIN} to T_{MAX}			100	
Break-Before-Make Time Delay (Note 3)	t_D	MAX393 only, R_L = 300Ω, C_L = 35pF, Figure 3		5	10		ns
Charge Injection (Note 3)	Q	C_L = 1.0nF, V_{GEN} = 0V, R_{GEN} = 0Ω, Figure 4	T_A = +25°C		2	5	pC
Off-Isolation (Note 7)	OIRR	R_L = 50Ω, C_L = 5pF, f = 1MHz, Figure 5	T_A = +25°C		72		dB
Crosstalk (Note 8)		R_L = 50Ω, C_L = 5pF, f = 1MHz, Figure 6	T_A = +25°C		85		dB
NC or NO Capacitance	$C_{(OFF)}$	f = 1MHz, Figure 7	T_A = +25°C		9		pF
COM Off-Capacitance	$C_{COM(OFF)}$	f = 1MHz, Figure 7	T_A = +25°C		9		pF
COM On-Capacitance	$C_{COM(ON)}$	f = 1MHz, Figure 8	T_A = +25°C		22		pF
SUPPLY							
Power-Supply Range				-8.0		+8.0	V
Positive Supply Current	I+	V+ = 5.5V, V- = -5.5V, V_{IN} = 0V or V+, all channels on or off	T_A = T_{MIN} to T_{MAX}	-1		+1	µA
Negative Supply Current	I-	V+ = 5.5V, V- = -5.5V, V_{IN} = 0V or V+, all channels on or off	T_A = T_{MIN} to T_{MAX}	-1		+1	µA

Precision, Quad, SPST Analog Switches

ELECTRICAL CHARACTERISTICS—Single +5V Supply

($V+ = +5V \pm 10\%$, $V- = 0V \pm 10\%$, GND = 0V, $V_{INH} = 2.4V$, $V_{INL} = 0.8V$, $T_A = T_{MIN}$ to T_{MAX}, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP (Note 2)	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	$V_{COM_}$, $V_{NO_}$, $V_{NC_}$	(Note 3)			0		V+	V
On-Resistance	R_{ON}	V+ = 4.5V, $I_{COM_}$ = -10mA, $V_{NO_}$ or $V_{NC_}$ = 3.5V	T_A = +25°C			30	60	Ω
			$T_A = T_{MIN}$ to T_{MAX}				75	
On-Resistance Match Between Channels (Note 4)	ΔR_{ON}	V+ = 5V, $I_{COM_}$ = -1.0mA, $V_{NO_}$ or $V_{NC_}$ = 3V	T_A = +25°C			0.8	2	Ω
			$T_A = T_{MIN}$ to T_{MAX}				4	
On-Resistance Flatness (Notes 3, 5)	$R_{FLAT(ON)}$	V+ = 5V, $I_{COM_}$ = -1.0mA, $V_{NO_}$ or $V_{NC_}$ = 1V, 3V	T_A = +25°C			2	6	Ω
			$T_A = T_{MIN}$ to T_{MAX}				8	
NO or NC Off-Leakage Current (Note 9)	$I_{NO(OFF)}$ or $I_{NC(OFF)}$	V+ = 5.5V, $V_{COM_}$ = 0V, $V_{NO_}$ or $V_{NC_}$ = 4.5V	T_A = +25°C		-0.25	±0.01	+0.25	nA
			$T_A = T_{MIN}$ to T_{MAX}	C, E	-0.1		+0.1	
				M	-2.5		+2.5	
COM Off-Leakage Current (Note 9)	$I_{COM(OFF)}$	V+ = 5.5V, $V_{COM_}$ = 0V, $V_{NO_}$ or $V_{NC_}$ = 4.5V	T_A = +25°C		-0.1		+0.1	nA
			$T_A = T_{MIN}$ to T_{MAX}	C, E	-2.5		+2.5	
				M	-5.0		+5.0	
COM On-Leakage Current (Note 9)	$I_{COM(ON)}$	V+ = 5.5V, $V_{COM_}$ = 5V, $V_{NO_}$ or $V_{NC_}$ = 4.5V	T_A = +25°C		-0.2		+0.2	nA
			$T_A = T_{MIN}$ to T_{MAX}	C, E	-5.0		+5.0	
				M	-20		+20	
DYNAMIC								
Turn-On Time	t_{ON}	$V_{NO_}$ or $V_{NC_}$ = 3V	T_A = +25°C			85	170	ns
			$T_A = T_{MIN}$ to T_{MAX}				240	
Turn-Off Time	t_{OFF}	$V_{NO_}$ or $V_{NC_}$ = 3V	T_A = +25°C			25	50	ns
			$T_A = T_{MIN}$ to T_{MAX}				100	
Break-Before-Make Time Delay (Note 3)	t_D	MAX393 only, R_L = 300Ω, C_L = 35pF			10			ns
Charge Injection (Note 3)	Q	C_L = 1.0nF, V_{GEN} = 0V, R_{GEN} = 0V, Figure 4	T_A = +25°C			1	5	pC
SUPPLY								
Positive Supply Current	I+	V+ = 5.5V, V_{IN} = 0V or V+, all channels on or off			-1		+1	µA
Negative Supply Current	I-	V+ = 5.5V, V_{IN} = 0V or V+, all channels on or off			-1		+1	µA

ELECTRICAL CHARACTERISTICS—Single +3.3V Supply

($V+ = +3.0V$ to $+3.6V$, GND = 0V, $V_{INH} = 2.4V$, $V_{INL} = 0.8V$, $T_A = T_{MIN}$ to T_{MAX}, unless otherwise noted.)

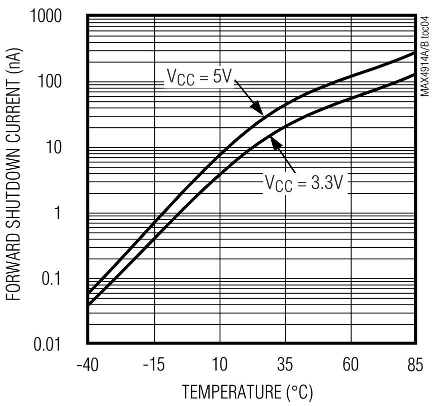
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	$V_{COM_}$, $V_{NO_}$, $V_{NC_}$	(Note 3)		0		V+	V
Channel On-Resistance	R_{ON}	V+ = 3V, $I_{COM_}$ = -1.0mA, $V_{NO_}$ or $V_{NC_}$ = 1.5V	T_A = +25°C		83	175	Ω
			$T_A = T_{MIN}$ to T_{MAX}			275	
DYNAMIC							
Turn-On Time (Note 3)	t_{ON}	$V_{NO_}$ or $V_{NC_}$ = 1.5V	T_A = +25°C		160	400	ns
			$T_A = T_{MIN}$ to T_{MAX}			500	
Turn-Off Time (Note 3)	t_{OFF}	$V_{NO_}$ or $V_{NC_}$ = 1.5V	T_A = +25°C		40	125	ns
			$T_A = T_{MIN}$ to T_{MAX}			175	
Break-Before-Make Time Delay (Note 3)	t_D	MAX393 only, R_L = 300Ω, C_L = 35pF	T_A = +25°C	20			ns
Charge Injection (Note 3)	Q	C_L = 1.0nF, V_{GEN} = 0V, R_{GEN} = 0V	T_A = +25°C		1	5	pC
SUPPLY							
Positive Supply Current	I+	V+ = 3.6V, V_{IN} = 0V or V+, all channels on or off		-1		+1	µA
Negative Supply Current	I-	V+ = 3.6V, V_{IN} = 0V or V+, all channels on or off		-1		+1	µA

Note 2: The algebraic convention, where the most negative value is a minimum and the most positive value a maximum, is used in this data sheet.
Note 3: Guaranteed by design.
Note 4: $\Delta R_{ON} = \Delta R_{ON}$ max - ΔR_{ON} min.
Note 5: Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal range.
Note 6: Leakage parameters are 100% tested at maximum rated hot temperature and guaranteed by correlation at +25°C.
Note 7: Off-isolation = $20 \log_{10} [V_{COM_} / (V_{NC_} \text{ or } V_{NO_})]$, $V_{COM_}$ = output, $V_{NC_}$ or $V_{NO_}$ = input to off switch.
Note 8: Between any two switches.
Note 9: Leakage testing at single supply is guaranteed by testing with dual singles.

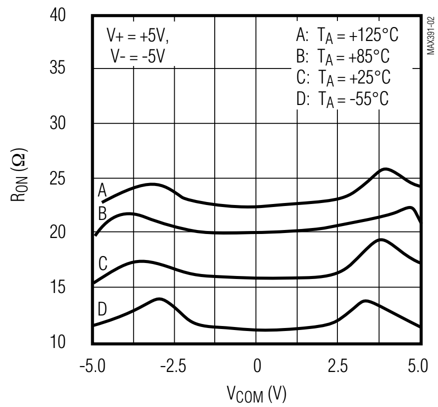
Typical Operating Characteristics

(T_A = +25°C, unless otherwise noted.)

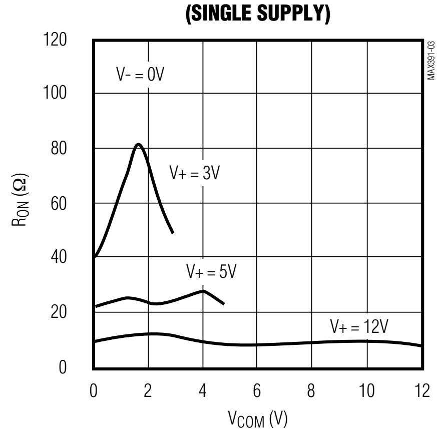
FORWARD SHUTDOWN CURRENT vs. TEMPERATURE



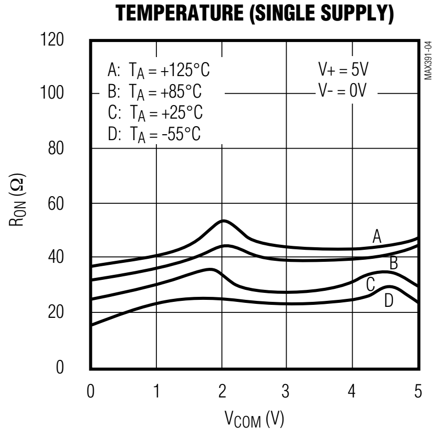
RON vs. VCOM AND TEMPERATURE (DUAL SUPPLIES)



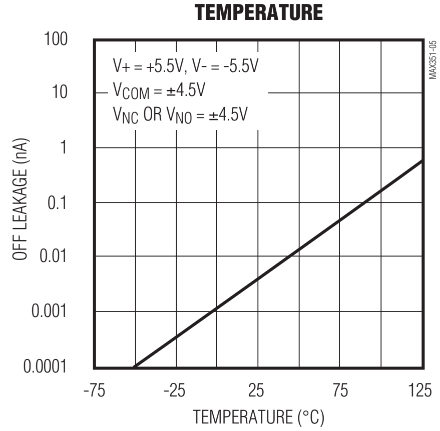
RON vs. VCOM (SINGLE SUPPLY)



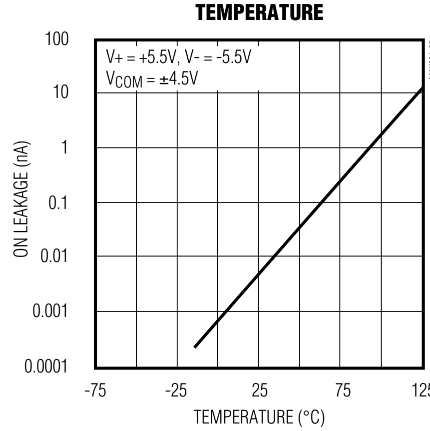
RON vs. VCOM AND TEMPERATURE (SINGLE SUPPLY)



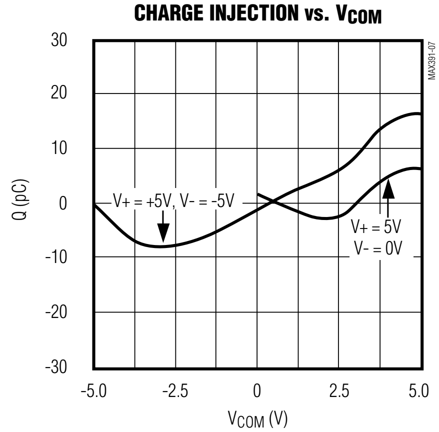
OFF-LEAKAGE CURRENT vs. TEMPERATURE



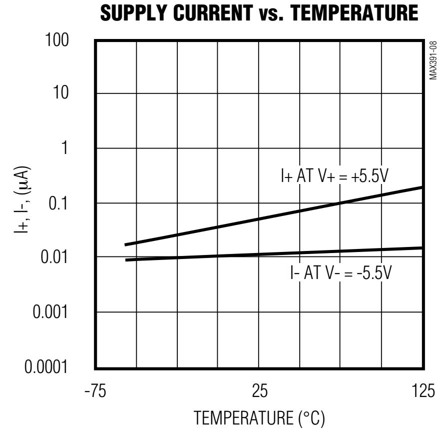
ON-LEAKAGE CURRENT vs. TEMPERATURE



CHARGE INJECTION vs. VCOM



SUPPLY CURRENT vs. TEMPERATURE



Pin Description

PIN		NAME	FUNCTION
DIP/SO/TSSOP	QFN		
1, 16, 9, 8	15, 14, 7, 6	IN1–IN4	Inputs
2, 15, 10, 7	16, 13, 8, 5	COM1–COM	Analog Switch Common Terminal
3, 14, 11, 6	1, 12, 9, 4	NO1–NO4 or NC1–NC4	Switch Inputs
4	2	V-	Negative-Supply Voltage Input
5	3	GND	Ground
12	10	N.C.	No Connection. Not internally connected
13	11	V+	Positive-Supply Voltage Input—connected to substrate
—	EP	EP	Exposed Pad. Connect to V+.

Applications Information

Overvoltage Protection

Proper power-supply sequencing is recommended for all CMOS devices. Do not exceed the absolute maximum ratings, because stresses beyond the listed ratings may cause permanent damage to the devices. Always sequence V+ on first, followed by V-, and then logic inputs. If power-supply sequencing is not possible, add two small signal diodes in series with supply pins for overvoltage protection (Figure 1). Adding diodes reduces the analog signal range to 1V below V+ and 1V below V-, but low switch resistance and low leakage characteristics are unaffected. Device operation is unchanged, and the difference between V+ and V- should not exceed 17V.

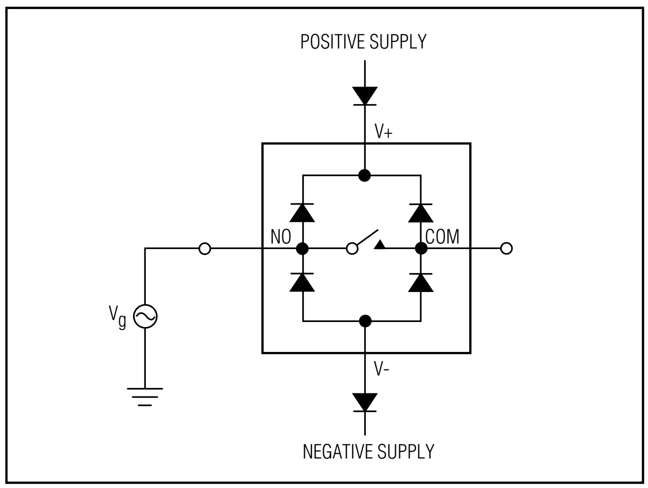


Figure 1. Overvoltage Protection Using Two External Blocking Diodes

Precision, Quad, SPST Analog Switches

Test Circuits/Timing Diagrams

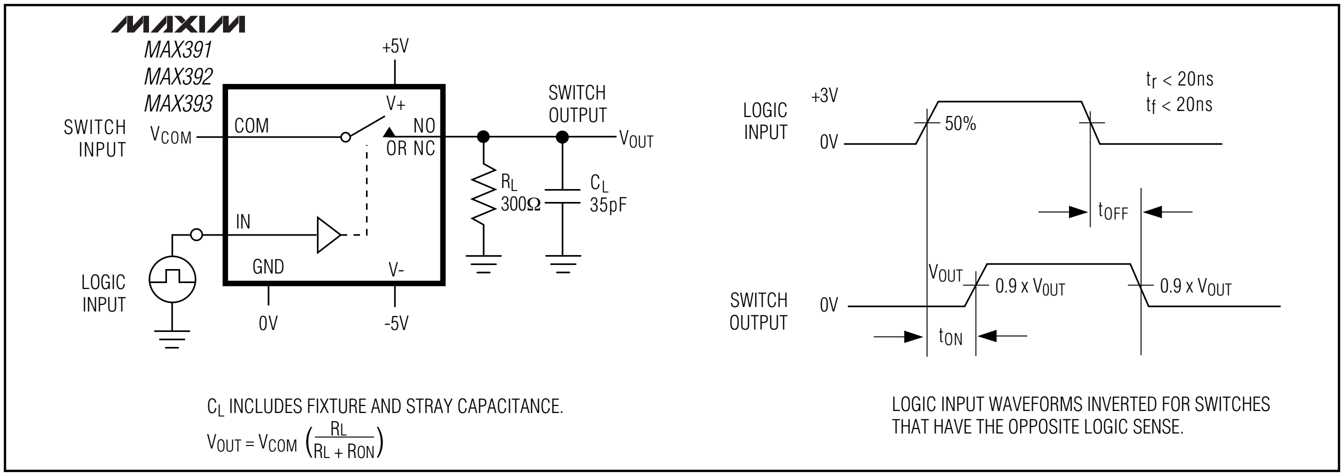


Figure 2. Switching Time

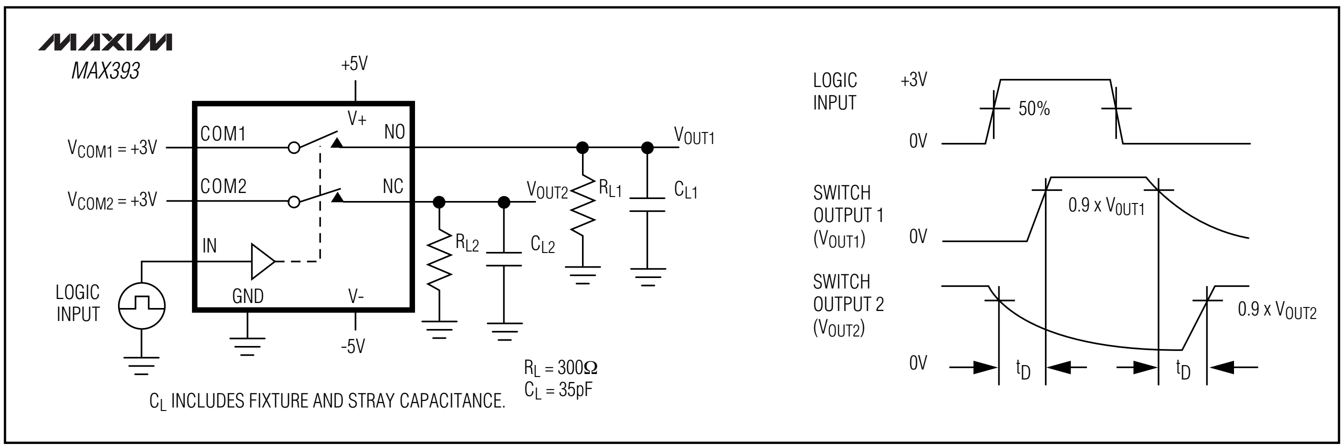


Figure 3. Break-Before-Make Interval (MAX393 only)

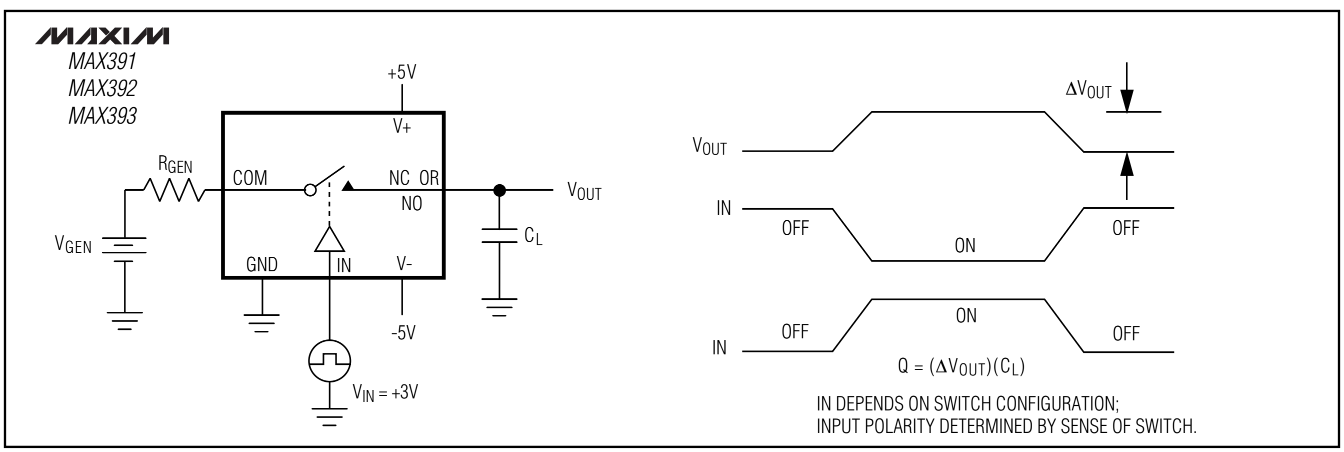


Figure 4. Charge Injection

Test Circuits/Timing Diagrams (continued)

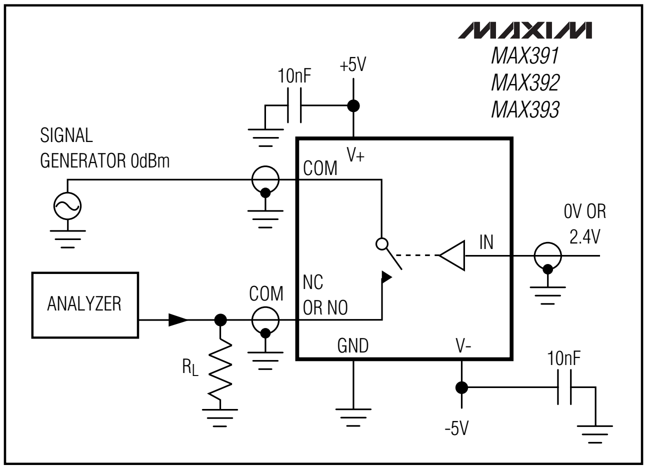


Figure 5. Off-Isolation

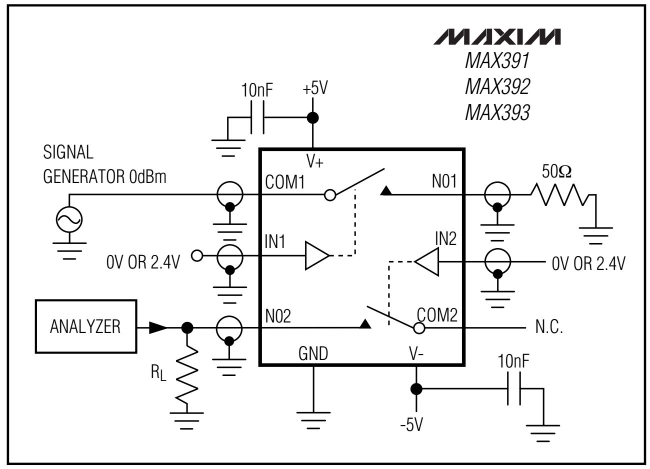


Figure 6. Crosstalk

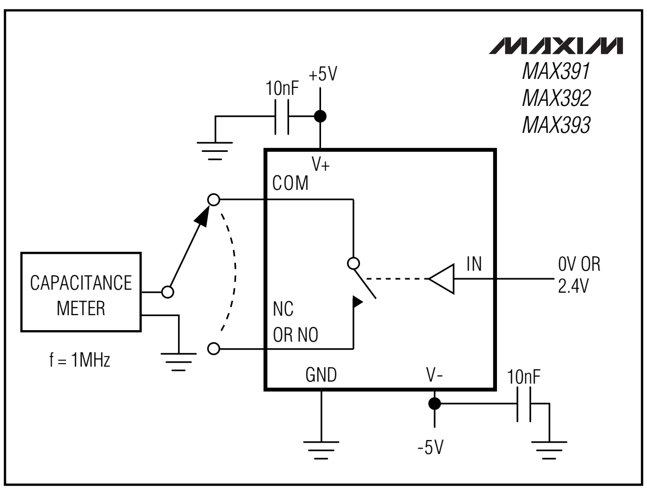


Figure 7. Channel Off-Capacitance

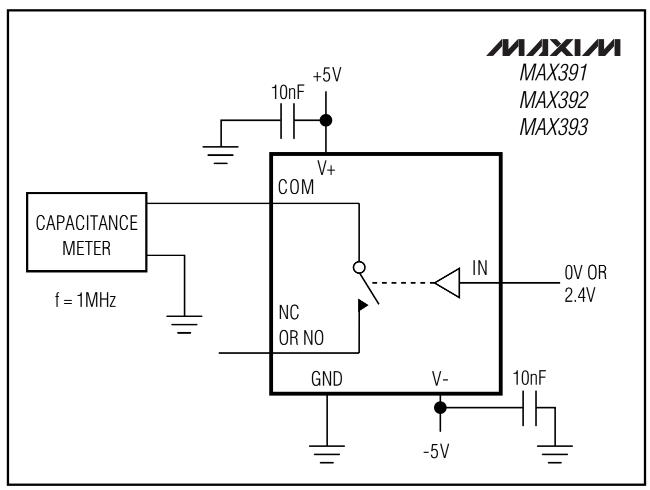


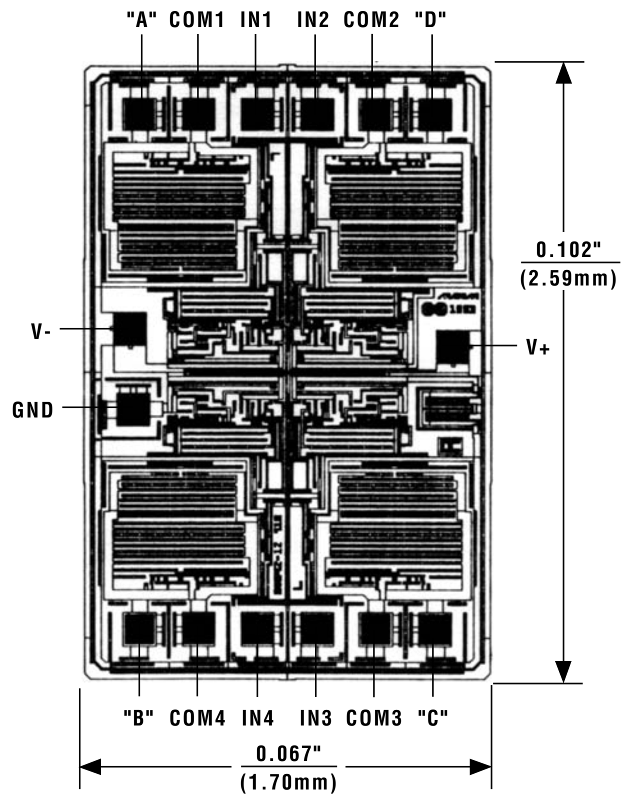
Figure 8. Channel On-Capacitance

Ordering Information (continued)

PART	TEMP RANGE	PIN-PACKAGE	PKG CODE
MAX391ESE	-40°C to +85°C	16 Narrow SO	S16-2
MAX391EUE	-40°C to +85°C	16 TSSOP	U16-2
MAX391EGE	-40°C to +85°C	16 QFN-EP†	G1655-3
MAX391EJE	-40°C to +85°C	16 CERDIP	J16-3
MAX391MJE	-55°C to +125°C	6 CERDIP**	—
MAX392CPE	0°C to +70°C	16 Plastic DIP	P16-1
MAX392CSE	0°C to +70°C	16 Narrow SO	S16-2
MAX392CUE	0°C to +70°C	16 TSSOP	U16-2
MAX392CGE	0°C to +70°C	16 QFN-EP†	G1655-3
MAX392C/D	0°C to +70°C	Dice*	—
MAX392EPE	-40°C to +85°C	16 Plastic DIP	P16-1
MAX392ESE	-40°C to +85°C	16 Narrow SO	S16-2
MAX392EUE	-40°C to +85°C	16 TSSOP	U16-2
MAX392EGE	-40°C to +85°C	16 QFN	G1655-3
MAX392EJE	-40°C to +85°C	16 CERDIP	J16-3
MAX392MJE	-55°C to +125°C	6 CERDIP**	—
MAX393CPE	0°C to +70°C	16 Plastic DIP	P16-1
MAX393CSE	0°C to +70°C	16 Narrow SO	S16-2
MAX393CUE	0°C to +70°C	16 TSSOP	U16-2
MAX393CGE	0°C to +70°C	16 QFN-EP†	G1655-3
MAX393C/D	0°C to +70°C	Dice*	—
MAX393EPE	-40°C to +85°C	16 Plastic DIP	P16-1
MAX393ESE	-40°C to +85°C	16 Narrow SO	S16-2
MAX393EUE	-40°C to +85°C	16 TSSOP	U16-2
MAX393EGE	-40°C to +85°C	16 QFN-EP†	G1655-3
MAX393EJE	-40°C to +85°C	16 CERDIP	J16-3
MAX393MJE	-55°C to +125°C	6 CERDIP**	—

*Contact factory for dice specifications.
**Contact factory for availability and processing to MIL-STD-883.
†EP = Exposed pad.

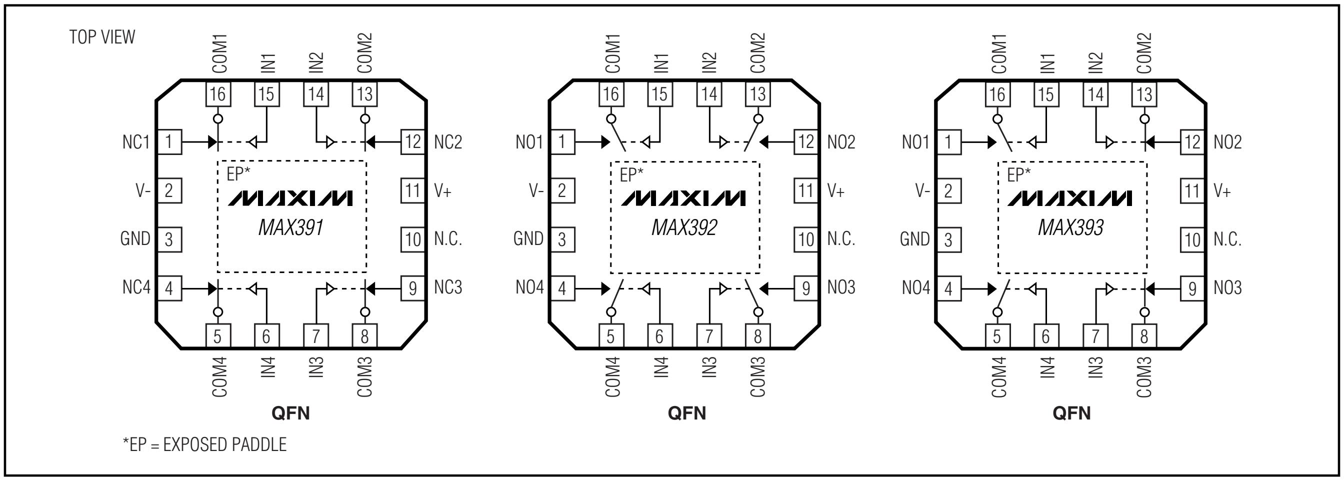
Chip Topography



MAX391		MAX392		MAX393	
PIN	NAME	PIN	NAME	PIN	NAME
A	NC1	A	NO1	A	NO1
B	NC4	B	NO4	B	NO4
C	NC3	C	NO3	C	NC3
D	NC2	D	NO2	D	NC2

TRANSISTOR COUNT: 76
SUBSTRATE CONNECTED TO V+

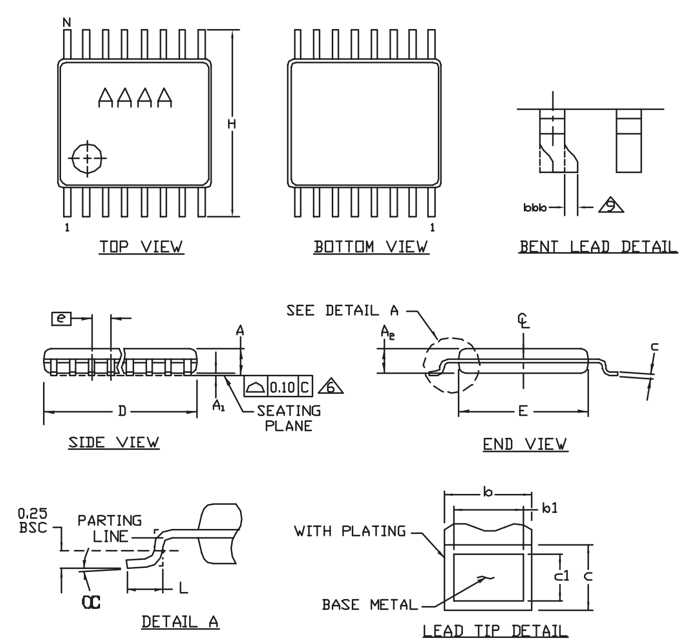
Pin Configurations/Functional Diagrams/Truth Tables (continued)



Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to **www.maxim-ic.com/packages**.)

TSSOP4.40mm.EPS



SYMBOL	COMMON DIMENSIONS			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	——	1.10		.043
A_1	0.05	0.15	.002	.006
A_2	0.85	0.95	.033	.037
b	0.19	0.30	.007	.012
b_1	0.19	0.25	.007	.010
c	0.09	0.20	.004	.008
c_1	0.09	0.14	.004	.006
D	SEE VARIATIONS		SEE VARIATIONS	
E	4.30	4.50	.169	.177
e	0.65 BSC		.026 BSC	
H	6.25	6.55	.246	.258
L	0.50	0.70	.020	.028
N	SEE VARIATIONS		SEE VARIATIONS	
α	0°	8°	0°	8°
bbb	0.10 MAX			

JEDEC MO-153	N		PKG. CODES	VARIATIONS			
				MILLIMETERS		INCHES	
				MIN.	MAX.	MIN.	MAX.
AB-1	14	D	U14-1, U14-2	4.90	5.10	.193	.201
AB	16	D	U16-1, U16-2	4.90	5.10	.193	.201
AC	20	D	U20-2, U20-3	6.40	6.60	.252	.260
AD	24	D	U24-1	7.70	7.90	.303	.311
AE	28	D	U28-1, U28-2, U28-3	9.60	9.80	.378	.386

NOTES
1. DIMENSIONS D AND E DO NOT INCLUDE FLASH
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm PER SIDE
3. CONTROLLING DIMENSION: MILLIMETER
4. MEETS JEDEC OUTLINE MO-153. SEE JEDEC VARIATIONS TABLE
5. "N" REFERS TO NUMBER OF LEADS
6. LEAD COPLANARITY 0.10 MM MAX.
7. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY
8. MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY
9. BENT LEAD 0.10 MM MAX.

-DRAWING NOT TO SCALE-

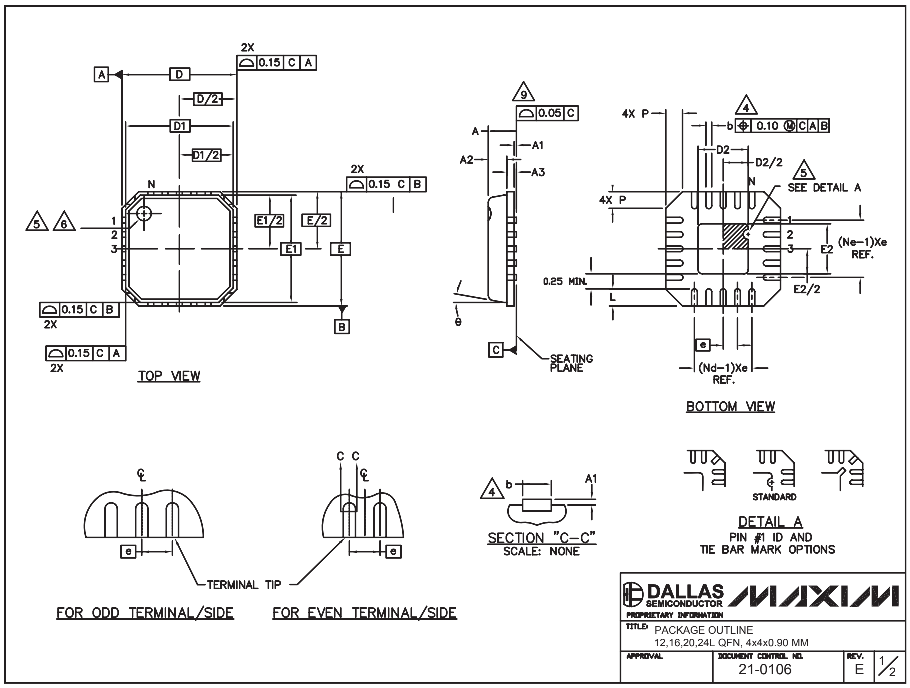
DALLAS SEMICONDUCTOR MAXIM

TITLE: PACKAGE OUTLINE, TSSOP 4.40mm BODY

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0066	I	1/1

Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to **www.maxim-ic.com/packages**.)



NOTES:

1. DIE THICKNESS ALLOWABLE IS 0.305mm MAXIMUM (.012 INCHES MAXIMUM).
2. DIMENSIONING & TOLERANCES CONFORM MUST TO ASME Y14.5M. – 1994.
3. N IS THE NUMBER OF TERMINALS.
   Nd IS THE NUMBER OF TERMINALS IN X-DIRECTION &
   Ne IS THE NUMBER OF TERMINALS IN Y-DIRECTION.
4. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.20 AND 0.25mm FROM TERMINAL TIP.
5. THE PIN #1 IDENTIFIER MUST BE EXISTED ON THE TOP SURFACE OF THE PACKAGE BY USING INDENTATION MARK OR INK/LASER MARKED. DETAILS OF PIN #1 IDENTIFIER IS OPTIONAL, BUT MUST BE LOCATED WITHIN ZONE INDICATED.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. ALL DIMENSIONS ARE IN MILLIMETERS.
8. PACKAGE WARPAGE MAX 0.05mm.
9. APPLIED FOR EXPOSED PAD AND TERMINALS.
   EXCLUDE EMBEDDING PART OF EXPOSED PAD FROM MEASURING.
10. MEETS JEDEC MO220; EXCEPT DIMENSION "b".
11. THIS PACKAGE OUTLINE APPLIES TO PUNCHED QFN (STEPPED SIDES).

SYMBOL	COMMON DIMENSIONS			NOTE
	MIN.	NOM.	MAX.	
A	0.80	0.90	1.00	
A1	0.00	0.01	0.05	
A2	0.00	0.65	0.80	
A3	0.20 REF.			
D	4.00 BSC			
D1	3.75 BSC			
E	4.00 BSC			
E1	3.75 BSC			
θ	0°	–	12°	
P	0.24	0.42	0.60	

SYMBOL	PITCH VARIATION A			NOTE	SYMBOL	PITCH VARIATION B			NOTE	SYMBOL	PITCH VARIATION C			NOTE	SYMBOL	PITCH VARIATION D			NOTE
	MIN.	NOM.	MAX.			MIN.	NOM.	MAX.			MIN.	NOM.	MAX.			MIN.	NOM.	MAX.	
e	0.80 BSC				e	0.65 BSC				e	0.50 BSC				e	0.50 BSC			
N	12			3	N	16			3	N	20			3	N	24			3
Nd	3			3	Nd	4			3	Nd	5			3	Nd	6			3
Ne	3			3	Ne	4			3	Ne	5			3	Ne	6			3
L	0.50	0.60	0.75		L	0.50	0.60	0.75		L	0.50	0.60	0.75		L	0.30	0.40	0.50	
b	0.28	0.33	0.40	4	b	0.23	0.28	0.35	4	b	0.18	0.23	0.30	4	b	0.18	0.23	0.30	4

PKG. CODE	EXPOSED PAD VARIATION D2			E2		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
G1244–2	1.95	2.10	2.25	1.95	2.10	2.25
G1644–1	1.95	2.10	2.25	1.95	2.10	2.25
G2044–3	1.95	2.10	2.25	1.95	2.10	2.25
G2044–4	1.55	1.70	1.85	1.55	1.70	1.85
G2444–1	1.95	2.10	2.25	1.95	2.10	2.25

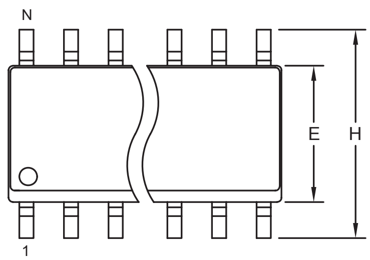
DALLAS SEMICONDUCTOR MAXIM
PROPRIETARY INFORMATION
TITLE: PACKAGE OUTLINE
12,16,20,24L QFN, 4x4x0.90 MM
APPROVAL | DOCUMENT CONTROL NO. 21-0106 | REV. E | 2/2

Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to **www.maxim-ic.com/packages**.)

SOICN .EPS

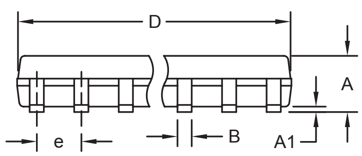
	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
e	0.050 BSC		1.27 BSC	
E	0.150	0.157	3.80	4.00
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27



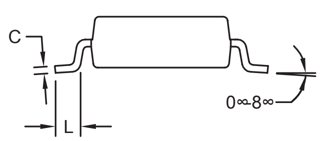
TOP VIEW

VARIATIONS:

	INCHES		MILLIMETERS			
DIM	MIN	MAX	MIN	MAX	N	MS012
D	0.189	0.197	4.80	5.00	8	AA
D	0.337	0.344	8.55	8.75	14	AB
D	0.386	0.394	9.80	10.00	16	AC



FRONT VIEW



SIDE VIEW

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm (.006").
3. LEADS TO BE COPLANAR WITHIN 0.10mm (.004").
4. CONTROLLING DIMENSION: MILLIMETERS.
5. MEETS JEDEC MS012.
6. N = NUMBER OF PINS.

DALLAS SEMICONDUCTOR MAXIM
PROPRIETARY INFORMATION
TITLE:
PACKAGE OUTLINE, .150" SOIC

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0041	B	1/1

Revision History

Pages changed at Rev 3: 1–11, 13

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